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THE EFFECT OF *STUNTING* ON COGNITIVE AND MOTOR DEVELOPMENT IN *TODDLER* CHILDREN : *LITERATURE REVIEW*

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Abstrak

Stunting is a condition in which toddlers have less length or height compared to age. Stunting can affect physical growth, motor development, and motor activity. Children who experience motor skills are caused by obstacles to the muscle maturity process so that muscle ability is reduced. Many studies say there is a link between cognitive and motor development. Objective: To study the effect of stunting against cognitive and motor development in children toddlers. This study is a systematic review of the literature. The inclusion criteria for search studies were quantitative research, free full text, Indonesian, or English. Selection of published articles with a range of 2015-2020 and free full text, after reading the title of the article and looking at the inclusion criteria, then it is re-selected by looking at the sample criteria based on age and development, and an assessment is carried out using the JBI format. There is a stunning effect on the cognitive and motor development of children ages toddler. The results of the study stated that children who were stunted had an 11.98 times greater chance of having motor development below average. As well as the mild stunting category with cognitive development suspect there is a delay in toddlers, namely not being able to mention the type of color, differentiating the size of the object, mentioning gender, pairing known images. While the moderate stunting category with cognitive development suspect or experiencing delays can result in reduced brain cells by 15-20 percent. Toddlers who experience the severe stunting category with cognitive development suspect there is a delay, marked by slow maturity of nerve cells, slow motor movements, lack of intelligence, and slow social response. Stunting affects cognitive and motor development in children toddlers. Some of the impacts that arise are memory decline, inaccuracy in storing objects, delays in verbal and non-verbal, and delays in thinking.
Keywords: Cognitive development, motor skills, stunting, and toddlers.

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INTRODUCTION

Stunting (dwarfism) is a condition in which toddlers have less length or height compared to age. This condition is measured by a length or height that is less than minus two standard deviations from the WHO's median child growth standard. Toddler stunting is a chronic nutritional problem caused by many factors such as socio-economic conditions, maternal nutrition during pregnancy, infant illness, and lack of nutritional intake in infants (Ministry of Health of Republic Indonesia, 2019)

In 2017 22.2% or 150.8 million children under five in the world experience stunting, but the figure is already experiencing a decline when compared with the figure of stunting in the year 2000 is 32.6%. In the year 2017, more than half of children under five stunting world come from Asia as much as 55% . Data prevalence of infant stunting was collected World Health Organization (WHO) (WHO, UNICEF & Group, 2018), Indonesia included in the country third with prevalence highest in Southeast Asia / South-East Asia Regional (SEAR). Results Riskesdas proportion of status of nutrition is very short and short in the toddler years 2007-2018 in Indonesia experienced a decline that is at 37.2 to 27.67 percent or t con. While in Java Barat proportion of status of nutrition is very short and short toddler years 2013 - 2018, namely from 35.3 to 31.1 percent, or down 4.2 percent in five years (Riskesdas, 2018).

The impact of malnutrition on children is stunting (short). Stunting is a chronic malnutrition problem caused by insufficient nutritional intake for a long time as a result of feeding that is not by the nutritional needs needed (Probosiwi et al., 2017) Stunting has a big impact on children's growth and development as well as Indonesia's economy in the future. Stunting can cause developmental problems in children, especially in children under two years of age. Children who are stunted will generally experience obstacles in their cognitive and motor development which will affect their productivity as adults (Ministry of Health of Republic Indonesia, 2019)

Early childhood period or period of childhood are often referred to with the term The Golden Age (0-5 years), the period of golden where all the advantages or privileges which are owned at the time it was not to be repeated for the second time. That is why this period is often referred to as the determining period for the next life. Periods in the range of age early an age of gold which the development of physical, intellectual, emotional, language, and social underway with quickly. The development of abilities, especially motor development, is very rapid. In the early days of life, starting at the age of 3, children begin to be able to accept skills like the basics for knowledge formation and thought processes (Probosiwi et al., 2017).

According to Maria (Pantaleon et al., 2016) poor motor and mental development in early childhood, as well as cognitive achievement in stunted children are closely related to growth and development in children under five. Stunting can directly affect brain development and affect physical growth, motor development, and motor activity. In stunted children, decreased motor function is related to the low mechanical ability of the tricep sure muscles so that the late maturity of the muscle function causes motor skills (Lindawati, 2012)

Based on research by Ruth & Ahmad (Probosiwi et al., 2017) it is revealed that there are differences in the development of stunting and non- stunting children with a p-value of 0.033. Types of development in stunted children that fall into the suspicious category consecutively include social personal development (87.5%), language

(75%), gross motor skills (25%), and fine motor skills (12.5%). Therefore, Ruth and Ahmad (2016) said that children who experience stunting cause low motor skills due to obstacles in the process of muscle maturity so that muscle ability is reduced. The process of forming and maturing muscle tissue is hampered if there is a shortage of nutrients in the long term, especially protein, fat, and energy.

In the research of (Lindawati, 2012), the factors that have a significant relationship with the nutritional status of children under five are the height of the mother, the level of energy and protein adequacy of toddlers, and the length of birth of the toddler. Factors that were significantly related to the level of gross motoric development and fine motor skills of children under five were the nutritional status of the children, the length of time attending PAUD, and the age of the toddlers. And the factors that have a significant relationship with the level of cognitive development of children under five are the nutritional status of children under five, the age of the toddler, the length of time attending PAUD, and the practice of child care by mothers.

(Manggala et al., 2018) state that the toddler period is the golden age period, some researchers also call it a critical period, this refers to that age when a human's growth and development are very rapid, especially in the brain development. This causes child growth and development is not optimal because children are malnourished and have low motor skills. Many studies say there is a relationship between cognitive and motor development in stunting children, such as in Ruth & Ahmad's 2016 study and Maria's 2015 study. There are still rare literature reviews related to the effect of stunting on cognitive and motor development in toddlers, this makes researchers interested in doing research related to the effect of stunting on cognitive and motor development in toddlers using a literature review study.

METODE

Types of research

This study is a systematic review of the existing literature to determine the results of previous studies on the effect of stunting on cognitive and motor development in toddlers.

Search Strategy

The search strategy aims to find articles that have already been published. The search was carried out via Google Scholar Pubmed. Keywords used in Indonesian are cognitive AND motor development AND stunting. The keywords used in English are *cognitive development AND motor development AND stunting AND toddler* (Dhamayanti & Herlina, 2016) . The search focused on journals on the effect of *stunting* on cognitive and motor development of toddlers, published from 2015 to December 2020.

The inclusion criteria for search studies are quantitative research, *free full text*, Indonesian, or English.

Study Quality Assessment

The assessment of the quality of each article is carried out using the standard format of the JBI *Critical Appraisal Checklist for Analytical Cross-Sectional Studies*. Consists of eight *checklist* items that are used to conduct an assessment with a choice of yes or no or unclear or not valid answers. The answer is yes when all the information in the checklist *is* explained in detail and correctly. Answer no, if not described in detail. It is not clear the meaning is explained but not detailed, while it is not valid, the meaning is not by the context of

this research. The conclusion of the quality of the article is done by using a percentage of the answer yes The article is concluded as good if the value is more than 8

RESULT

From the search results conducted through Google Scholar and Pubmed with keywords in Indonesian cognitive AND motor development AND stunting AND toddler and keywords in English cognitive development AND motor development AND stunting AND toddler, a selection of articles published with a range of 2015-2020 was carried out. and free full text, there are 467 articles on Google Scholar and 10 articles on PUBMED, after reading the article title and looking at the inclusion criteria, 26 articles were found that were suitable, then they were re-selected by looking at the sample criteria based on age and development, so there were 4 articles that could be analyzed.

In the four articles, an assessment was carried out using the JBI format that in (Arini et al., 2019) obtained a value of 100%, (Probosiwi et al., 2017) obtained a value of 100%, (Nahar et al., 2019) got a value of 100% and (Pantaleon et al., 2016) got a value 100%.

Summary of Search Result

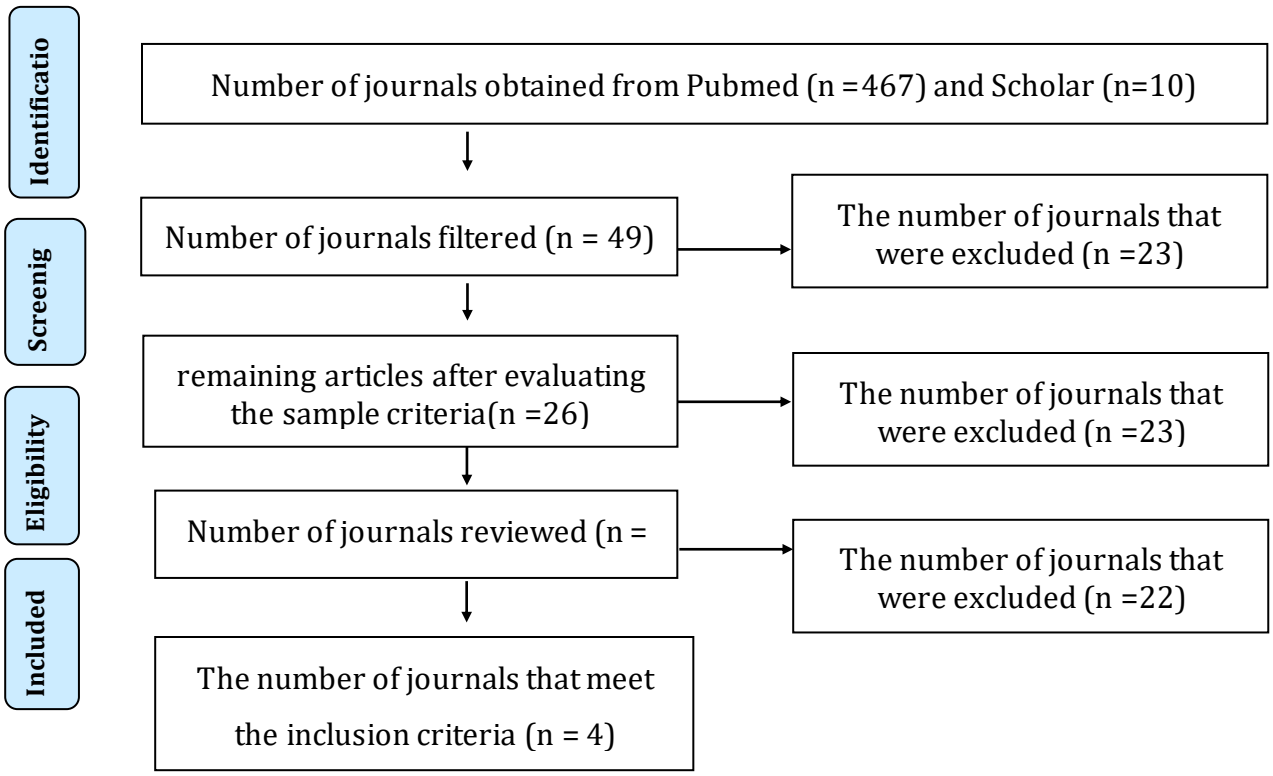

Chart 1: Summary of Search Result

Research Characteristics

Four articles were included in the literature review according to the inclusion criteria that had been set. The publication year span of the five articles is from 2015-2020. In the five articles, there are similarities and differences including the number of respondents, the characteristics of the respondents, the place of research, the research methods, the instruments used, and the results of the research, with the following descriptions:

Number of respondents

Research by (Arini et al., 2019) has many respondents as many as 145 children. Research (Probosiwi et al., 2017) has a total number of respondents as many as 106 children. And the research of (Nahar et al., 2019) has 189 people. (Pantaleon et al., 2016) have a total of 100 children as respondents.

Place of research

(Arini et al., 2019) was conducted in Surabaya. (Probosiwi et al., 2017) was conducted in Kalasan Sleman Yogyakarta. (Nahar et al., 2019) study was conducted in Bangladesh and (Pantaleon et al., 2016) study was conducted in Yogyakarta.

Respondent characteristics

All five articles obtained, it was conducted on children aged 1-3 years.

Research methodology

(Arini et al., 2019) used a correlation research design with a cross-sectional approach, with data processing using the *rho spearmen* test. (Probosiwi et al., 2017) used a *cross-sectional* research design with data analysis using logistic regression tests. (Nahar et al., 2019) uses the chi-square test for categorical variables and a two-way t-test for continuous variables and Research (Pantaleon et al., 2016) uses the chi-square test and logistic regression with 95% confident interval.

The instrument used

Arini's research (2019) uses the Capute Scale for cognitive development and DDST II for motor development. Hardiana's research (2017) uses DDST II. Baitun Nahar (2019) and Maria (2015) research using Bayley Scales of Infant Development III.

Research result

Based on these four research journals, it is stated that most of the effects of stunting greatly affect cognitive and motor development in toddlers. In the research of Arini et al (2019), there is a relationship between the degree of stunting and impaired cognitive and motor development, this is indicated by the results of the *Spearman rho* test on cognitive development with a value of sig = 0.044, gross motor development sig = 0.028 and fine motor development of children sig = 0.006 with (sig $<\alpha = 0.05$). In Hardiana et al's (2017) study, stunting status with child development shows that there is a significant relationship (p <0.05) and an OR value of 3.9 (95% CI; 1.7-8.9), the results of multivariable analysis controlling body length and energy intake had a major effect on 8% of the development of children aged 12-60 months. In Baitun Nahar (2019) study, children who are stunted have significantly lower developmental scores than children who are not inhibited in all domains: cognitive (95% CI = −0.16 [−0.31, 0.0], P =. 049), motor (95% CI = −0.41 [−0.6, −0.2], 049). These children also had z Core deficits in fine motor skills (95% CI = −0.21 [−0.41, −0.01], P =. 039), gross motor skills (95% CI = −0.45 [−0.5, −0.25]. Boys had significantly lower fine motor skills (95% CI = 0.20 [0.02, 0.38]. In Maria's (2015) study, there was a

significant relationship between stunting and motor development (p = 0.002).), but there is no significant relationship between stunting and cognitive development.

Table 1
Summary of Research Characteristics

No.	Author, Year, Place	Sample	Instrument	Data analysis technique	Result
1.	Impaired Motor and Cognitive Development in Toodler's Children Experiencing Stunting in the Coastal Area of Surabaya (Arini et al., 2019)	The sample consisted of 145 children. The technique used is random sampling. Inclusion Criteria: children aged 1-3 years and willing parents his son researched	Zscore table, *Capute Scale* cognitive development checks and DDST (*Denver Development Screening Test*)	Data analysis using test *spearmen rho*	There is a relationship between the degree of stunting and the disturbance development cognitive and motor things this is shown from *Spearman rho* test results on cognitive development with a sig = 0.044, gross motor development sig = 0.028 and fine motor development of children sig = 0.006 with (sig <α = 0.05).
2.	Early Childhood Development and Stunting: Findings From the MAL-ED Birth Cohort Study in Bangladesh (Nahar et al., 2019)	The sample was 189 children. Inclusion criteria: children aged 24 months (*toddler*)	Bayley Scales of Infant and Toddler Development-third version (BSID-III; Bayley, 2005)	Uses the chi-square test for categorical variables and a two-way t test for continuous variables.	The children who were stunted had significantly lower progression scores than the children who were not inhibited in all domains: cognitive (95% CI = −0.16 [−0.31, 0.0], P = .049), motor (95% CI. = −0.41 [−0.6, −0.2], 049). These children also had z Core deficits in fine motor skills (95% CI = −0.21 [−0.41, −0.01], P =. 039), gross motor skills (95% CI = −0.45 [−0.5, −0.25]. Boys had significantly lower fine motor skills (95% CI = 0.20 [0.02, 0.38].
3.	Stunting and development of children aged 12-60 months in Kalasan (Probosiwi et al., 2017)	The number of samples was 106 children, taken by purposive random sampling. Inclusion Criteria: Children aged 12-60 months.	DDST (*Denver Development Screening Test*)	Data analysis with univariable, bivariable with chi-square test with a level Significance p <0.05 and CI 95% and multivariable with logistic regression statistical test.	Stunting status with child development indicated that there was a significant relationship (p <0.05) and an OR value of 3.9 (95% CI; 1.7-8.9). Results of multivariable analysis controlling body length and energy intake has a major effect on the development of children aged 12-60 months.
4.	Stunting Associated with Children's Motoric Development in Sedayu District, Bantul, Yogyakarta	The number of samples is 100 children. The study was taken using a consecutive sampling technique. Inclusion criteria: Children 6-23 months	Bayley Scales of Infant Development III.	Data analysis using the chi-square test and logistic regression with 95% confident interval.	The motor development of children who are more *stunted* much less (22%) in comparison with non *stunting* children (2%). also, the proportion of children who develop motor skills well was 20% higher in non-

(Pantaleon et al., 2016)	of age.	*stunting* children. Children who are *stunted* more have less cognitive development (12%) when compared to children who are not *stunted* (8%)

DISCUSSION

In four articles that were analyzed, stunting affects the cognitive and motor development of children ages toddler. The cause of stunting is caused because of no exposure to the intake of food that is not sufficient for pregnancy are indirect causes that contribute to fetal growth and development. Pregnant women with malnutrition will cause the fetus to experience *intrauterine growth retardation* (IUGR), so that the baby will be born with less nutrition and experience growth and development problems (Ministry of Health, 2011).

Stunting affects cognitive and motor development in children toddler, research (Arini et al., 2019) which states that there is a relationship between the degree of stunting the development of the child. It mentioned by the opinion (Jilid I, n.d.) explains that the status of nutrition is one of the determinant factors of the development of the child. In toddlers, aspects of growth and development are one of the aspects that are considered for explaining the process of the formation of a person, children under five are physical or psychological. Sphere development of children consisting of motor rude, motor smooth, language, and speech, as well as personal social / independence (Jilid I, n.d.)

Based on the results of the research in the mild stunting category with cognitive development, there were as many as 27 children (76.7%) and 23 children (76.7%) who suspected that there were delays in toddlers in the Surabaya Coastal Area. severe stunting category with cognitive development, as many as 78 children (92.9%) suspected delays. The results also explained that the distribution of mastery of cognitive development in children with stunting was 73.1% unable to state the type of color, distinguish object size, mention gender, pair familiar images.

The effect of nutrient intake on impaired child development is preceded by a decrease in nutritional status. This will cause the child not to have a good experience with brain stimulation, thus affecting the child's intelligence. In the aggregate, these conditions hamper children's growth and development (Manggala et al., 2018).

In (Probosiwi et al., 2017) study, maternal education, infectious diseases, parenting styles, energy intake, birth length, and parental income were not statistically significant. However, maternal education is practically related to child development. Mothers with low education find it difficult to stimulate children's knowledge and hurt their children. The parenting style in this study did not have a statistical relationship, but it was practical. Early interventions for child development and communication by caregivers improve children's interactions with mothers, the environment, and children's behavior are useful for improving child feeding and development.

Nutrition has an important role in the state of stunting, nutrition ensures that the development and growth of children's brain cells take place normally and well. Adequacy of nutrition affects the process of child development, especially during the golden age period.

Developmental delay disorders are characterized by slow maturity of nerve cells, slow motor movements, lack of intelligence, and slow social response. Various stimulations through the five senses such as hearing, seeing, feeling, smelling, and feeling are given. (P et al., 2015)

(Pantaleon et al., 2016) states that there is a significant relationship between stunting and motor development, but there is no significant relationship between stunting and cognitive development in children under two years. For the sake of creating optimal quality children's futures, detection, stimulation, and intervention of various growth or development deviations must be carried out early on. Motor development is often ignored by health workers and parents as an influencing factor in the future. Good motor intelligence can improve a person's quality of life in the future (Warsito et al., 2012).

In (Nahar et al., 2019) study, stunting children have developmental deficits in all domains including cognitive: P = 001, fine motor skills: P 039, and P <001 gross motor skills. According to researchers, fine motor activities include the ability to produce precise, efficient, and adaptive movements using the small muscles of the fingers, toes, lips, and tongue as well as eye and hand coordination simultaneously. Gross motor skills involve movements that use the large muscles in the arms, legs, chest, and legs. This study states that stunting hurts cognitive function and is found in many low-income countries. Children whose growth is stunted continuously have lower cognitive levels than children who are not stunted growth. Poor cognitive appears on the point test of attention, working memory, learning, and the ability to place objects.

In toddlers who are stunted, the role of parents, especially mothers, has a strong influence in providing special stimuli in the form of providing or supporting early childhood education for their children, providing food intake from pregnancy to 2 years of age to prevent malnutrition and infectious diseases. in the occurrence of stunting and providing facilities for providing toys to support development, especially cognitive and motor development. The more severe the child is stunted, it will result in developmental delays in the child. It is closely related to the interplay of growth and development processes.

CONCLUSION

Based on the results of the literature review that has been analyzed, four articles that analyzed concluded that: Stunting affects cognitive and motor development in children toddlers. Some of the impacts that arise include a decrease in memory, inaccuracy in storing objects, delays in verbal and non-verbal, and delays in thinking.

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CONFLICT OF INTEREST

The author has no conflict of interest to declare.

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